TECHNICAL REPORTS
ON ARCHAEOLOGICAL REMAINS

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By

JULIET CLUTTON-BROCK : VISHNU-MITTRE : A. N. GULATI

Deccan College Post-graduate & Research Institute, Poona 6.

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INTRODUCTION

The Institute has great pleasure in publishing the three technical reports in this Monograph. A full report on the excavations at Langhnaj which the Institute began in 1941-42 and carried on until 1948-49 is long overdue. The delay has been due to the fact that a large number of animal bones and human skeletons had been collected during the excavations, which required a very careful study by a competent scholar. Professor F. E. ZEUNER kindly undertook the study of the animal remains, but owing to his other engagements, he could not find as much time as these individual bones demanded. Fortunately, one of his students, Miss Juliet CLUTTON-BROCK, has now come forward to study these, and I understand that very soon her entire report will be ready for publication. Meanwhile, Miss CLUTTON-BROCK's identification of an entire mongoose skeleton found in 1949 is included in this Monograph.

We are glad to announce that Dr. (Mrs.) Sophie ERHARDT, Professor of Anthropology in the University of Tübingen, has completed the study of the Langhnaj human skeletons. It is hoped to publish this report along with other reports on Langhnaj.

The present Monograph also contains a full report by Dr. Vishnu MITTRE on the various charred grains and fruits found in the excavations which the Institute has conducted at Maheshwar and Navdatoli in the present State of Madhya Pradesh jointly with the Maharaja Sayajirao University of Baroda and with the co-operation of the Department of Archaeology, Government of Madhya Pradesh, since 1952-53. The report deals primarily with large quantities of the materials found in 1957-58 and 1958-59 seasons. While Dr. Vishnu MITTRE's study gives an insight into the dietary habits of the people of Central India some 4000 years ago and the antiquity of several grains, Dr. GULATI's study of the thread found in a copper-bead necklace in one of the pot-burials of the Chalcolithic deposit at Nevasa, which the Institute has been excavating with the help of the Poona University and (the former) Department of Archaelogy, Bombay State, is extremely interesting and no less important. This little find at once proves the existence of spun cotton and silk material as clothing and/or for decoration as early as 1500 B.C. in the Deccan. Further it also shows the antiquity of the practice of stringing necklaces in silk thread which obtains today in India. Equally interesting are Dr. GULATI's ancillary conclusions

regarding the use of cow-dung and some kind of millet oil for anointing the body either before or after death. The former has still retained its purificatory usage even in the urban and so-called civilized centres, while an oil bath is a *must* with all the people in South India. But some communities, for instance the Gigalas of Mysore, anoint the body even after death. Thus anthropologically these Nevasa burials will prove to be extremely important. This season (1961), a part of a copper-bead necklace was found in the Chalcolithic deposits at Chandoli, some 40 miles north of Poona in the same District. It is awaiting examination.

It may be mentioned that Carbon-14 dates are available, thanks to the Physics Department of the Pennsylvania University, for both the Navdatoli and Nevasa Chalcolithic deposits. The former ranges from 3503 ± 128 to 3294 ± 125 B.P., and the top of the latter is dated to 3106 ± 122; but as pointed out in our Nevasa Report it should go back to at least 1500 B.C.

The Institute is indeed thankful to Professor F. E. ZEUNER and his student, Miss Juliet CLUTTON-BROCK, to Dr. Vishnu MITTRE as well as to Dr. GULATI and to Dr. MOTI CHANDRA, Director of the Prince of Wales Museum of Western India, Bombay, for extending their co-operation and services in unfolding the technical aspects of our prehistoric past.

Deccan College,
Poona,
14th June 1961.

H. D. SANKALIA
Professor and Head of the Deptt. of Ancient Indian History & Archaeology.

I

THE MONGOOSE SKELETON

FOUND AT

THE MICROLITHIC SITE, LANGHNAJ

(Gujarat)

By

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Department of Environmental Archaeology
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THE MONGOOSE SKELETON FOUND AT THE MICROLITHIC SITE OF LANGHNAJ, GUJARAT, 1949[1]

By

JULIET CLUTTON-BROCK

ABSTRACT

[A description is given of the methods used in the specific identification of a mongoose skeleton excavated at the microlithic site of Langhnaj in India. The specimen was compared morphologically and by measurement with the large series of mongoose skulls in the collection of the British Museum (Nat. Hist.). It has been identified as belonging to the species *Herpestes edwardsi* cf. *ferrugineus* Blanford, 1874.]

INTRODUCTION

The site of Langhnaj was excavated between the years 1941 and 1949 by Dr. H. D. SANKALIA and other workers from the Deccan College Post-Graduate Research Institute at Poona. The faunal remains are at present being studied and include the teeth and bones of cattle and deer, some bones of *Rhinoceros unicornis*, the jaws of a dog or wolf and the mongoose skeleton which is described below.

The site is situated in Northern Gujarat between the Rupen and Sabarmati rivers, on an ancient sand-dune called "Andhario Timbo." The stratigraphy of the area was described by ZEUNER (1950). The animal bones, including the mongoose skeleton, were associated with a buried soil horizon that marks the pre-pottery microlithic habitation site. This horizon is followed conformably by upper levels containing Iron Age pottery, probably 2,000 years old.

IDENTIFICATION

The skull and axial skeleton of the mongoose from Langhnaj are almost complete (Fig. 1), although the bones were encrusted with calcium carbonate and in a somewhat crushed condition. The limbs and some of the vertebrae are missing, but the otherwise complete state of the skeleton and its position in the soil suggest that the animal died in a burrow and not on the surface of the occupation site, where the bones would have been dispersed. It is therefore possible that the skeleton is somewhat later than

(1) Seventh Report on the Indian Geochronological Expedition, 1949

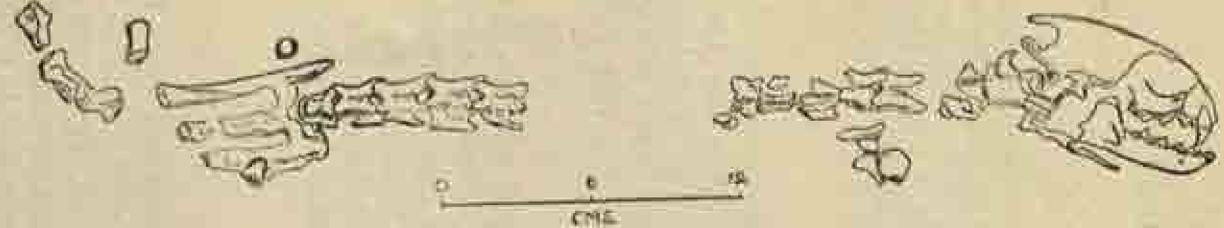

Figure 1. Sketch of the mongoose skeleton as it was excavated from the site of Langhnaj.

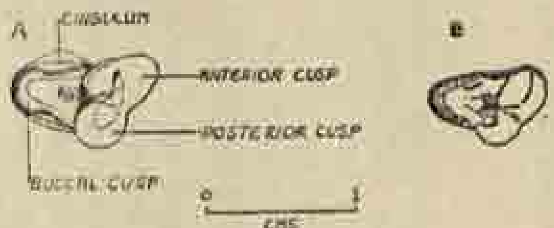

Figure 2. (A) *Herpestes vitticollis*, British Museum (Nat. Hist.) no. 143B, Palatal view of the upper left first molar to show development of the characteristic cingulum.

(B) Langhnaj specimen. Palatal view of the upper left first molar 1.

the pre-pottery microlithic occupation of the site although it was found at the same level as the other animal bones.

The upper and lower jaws of the mongoose skull were soaked in dilute acetic acid to remove the calcium carbonate deposit and then in polyvynil acetate to harden them. The rest of the skull and skeleton were left embedded in a thin layer of earth in plaster of Paris because they were too crushed for measurements to be taken from them with any degree of accuracy.

Ellerman and Morrison-Scott (1951) recognise six species of mongoose that are found in India at the present day. These are:

Herpestes vitticollis Bennett, 1835
Herpestes urva Hodgson, 1836
Herpestes auropunctatus Hodgson, 1836
Herpestes fuscus Waterhouse, 1836
Herpestes edwardsi Geoffroy, 1818
Herpestes smithi Gray, 1837

Pocock (1937) reviews the Recent Indian species of mongoose, and he gives a descriptive key based on skull structure and external features. This work was based on the large collection of skulls and skins in the British Museum (Nat. Hist.) and shows that specific differences can be seen in the skull structure. In order to attempt an identification of the Langhnaj animal, measurements were made of this specimen and compared with measurements from the series of skulls of all six species in the British Museum (Nat. Hist.) (see Table I p. 9). The dimensions taken were those of the upper and lower tooth rows, the height of the maxilla below the orbit, the length of the mandible, and the depth of the horizontal and vertical rami. They are shown in Fig. 3(A) and numbered I-VI. Ratios, for example, height of vertical ramus to length of mandible, were not found to be such a satisfactory means of distinction as measurements of the absolute heights and lengths. Therefore they are not recorded.

These measurements support the conclusions of Pocock and show that overall size is a reasonably constant feature of each species although there is a marked sexual difference within the species.

The Langhnaj skeleton is that of a fully adult animal; the bones have attached epiphyses and all the teeth have erupted. Only adult skulls

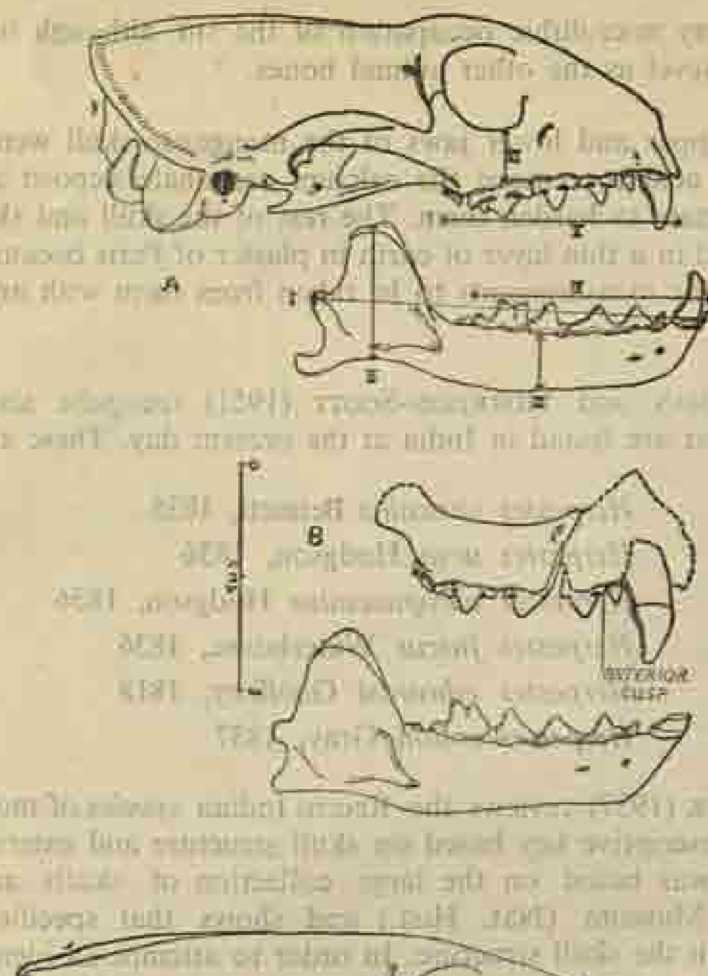

Figure 3. A *Herpestes edwardsi ferrugineus*, British Museum (Nat. Hist.) no. 15.11.1.73♀
Numbers I-VI denote measurements described in the text.
B Maxilla and mandible of the Langhnaj specimen.
C *Herpestes smithi smithi*, British Museum (Nat. Hist.) no. 19.6.3.40.♀.

from the Museum collection were measured and as the identification of the Langhnaj specimen had to be based mainly on the structure of the teeth and jaws a close examination of the dentition was made in the six species. Differences were found to exist in the degree of development of the minor cusps and these are consistent within each species, so that identification from the jaws alone can be attempted.

The dental formula of the mongoose as it has been used in this paper is:

$$I\,\frac{3}{3},\ C\,\frac{1}{1},\ P\,\frac{4}{4},\ M\,\frac{2}{2}.$$

Herpestes vitticollis is the largest species of mongoose found in India. The teeth are very large and the upper and lower second molars are larger in proportion to the rest of the teeth than those of any other species. The teeth are easily distinguishable, apart from their large size, by the presence of a well-developed cingulum on the upper first molars that is characteristic of the species. The Langhnaj skull is very much smaller than all those belonging to adult specimens of *H. vitticollis* in the Museum collection and the upper molar does not have a cingulum (Table 1 and Fig. 2).

Herpestes urva, the Crab-eating Mongoose, is a species approaching *H. vitticollis* in size and the one skull in the British Museum (Nat. Hist.) is much too large for the Langhnaj specimen (Table 1 p. 9).

Herpestes auropunctatus, the Small Indian Mongoose, was described by Pocock (1937) as a subspecies of *Herpestes javanicus* Geoffroy, 1818, the Javan Mongoose, but Ellerman and Morrison-Scott (1951) give it specific status. This is the smallest Indian mongoose and the skull measurements fall well below those of the Langhnaj specimen (Table 1 p. 9).

Remains of *H. auropunctatus* were found at Mohenjo-Daro, in the Indus Valley civilization levels, and were described by Seymour Sewell and Guha (1931).

Herpestes fuscus forms a group of five subspecies that have been described by Pocock (1937) and by Ellerman and Morrison-Scott (1951). Four of these are found at the present day only in Ceylon, and the fifth, *H. fuscus fuscus* Waterhouse, 1838, occurs in Southern India. This subspecies is found in hilly forested districts between 3000 and 6000 feet, and for this reason it is improbable that its remains should be found in the semi-arid plains of Northern Gujarat. Nevertheless the dimensions of the skull

of the Langhnaj mongoose fall within the range presented by the five skulls in the Museum collection. The dentition of *H. fuscus fuscus* was closely examined therefore, and the teeth were found to have certain constant features that enable this mongoose to be distinguished from the Langhnaj specimen and from other species of the same size. As described by BLANFORD (1891), the teeth are all relatively large, especially the lower second molars which are distinctive in having three anterior cusps instead of two as in other species. Unfortunately the tops of the crowns of the lower second molars of the Langhnaj specimen are damaged, but the remaining parts are small and there is no evidence of there having been three anterior cusps.

The upper second premolar of *H. fuscus fuscus* has a well-developed anterior cusp and this is either absent or only slightly developed in other species. It is not well developed in the upper second premolar of the Langhnaj specimen and looks more like a thickening of the cingulum than an actual cusp that is divided off from the rest of the crown. In *H. fuscus fuscus* the anterior cusp is also more strongly developed in the third and fourth upper premolars.

These features, taken together with the present-day distribution of the race in the tropical rain forest belt of Southern India, indicate that the Langhnaj specimen does not belong to this species, although it must be emphasized that present-day distribution may bear little relation to fossil distribution and can only be taken into account with caution.

Herpestes edwardsi and *Herpestes smithi* are two species which in their external appearance differ from each other only in that *H. smithi*, the Ruddy Mongoose, has a black tip to its tail and is slightly larger than *H. edwardsi*. POCOCK (1937) suggests that *H. smithi* is an ecotype of *H. edwardsi* and not a separate species.

H. edwardsi, the Common Grey Indian Mongoose, is widespread throughout the Peninsula of India. It is found in hedgerows, fields and around buildings, but not in dense forest which is the habitat of *H. smithi*.

The skull structure and dentition of these two species are very similar and both species are very variable in size, although *H. smithi* is on the whole the larger animal (Figs. 3A & B). Measurements of the Langhnaj skull fall within the range of *H. smithi*, as shown by the dimensions of the skulls in the Museum collection, but they fall only in the upper limits of the range for *H. edwardsi*.

The dentition of *H. edwardsi* somewhat resembles that of *H. fuscus fuscus* in that the upper second premolar has an anterior cusp, but it is never so well developed as in the latter species. The upper second premolar of *H. smithi* has no anterior cusp. This is the only distinction that could be found between the dentitions of *H. edwardsi* and *H. smithi* (Fig. 3).

Whereas the Langhnaj skull more closely resembles the skulls of *H. smithi* in size and in general proportions, in respect of the distinguishing tooth character it is nearer to *H. edwardsi*, as the upper second premolar has a small but distinct thickening at the base of the crown and, although this could not be described as a distinct cusp, it is more highly developed than was found in any of the specimens of *H. smithi* (Fig. 4). This tooth character is consistent within the two groups and is therefore a better means of distinction than measurement of skull size because the size ranges of the two species overlap (Table 1). For this reason the Langhnaj specimen is identified as belonging to the species *Herpestes edwardsi*.

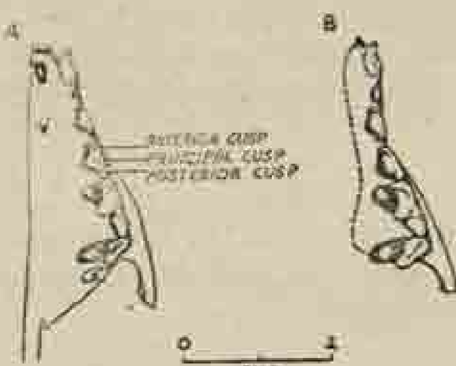

Figure (4) (A) *Herpestes edwardsi ferrugineus*, British Museum (Nat. Hist.) no. 15.11.1.73♂. Palatal view of the dentition.
(B) Langhnaj specimen. Palatal view of the dentition.

Four subspecies of the Common Mongoose have been described (Pocock, 1937, Ellerman and Morrison-Scott, 1951):

Herpestes edwardsi nyula Hodgson, 1836
Herpestes edwardsi ferrugineus Blanford, 1874
Herpestes edwardsi edwardsi Geoffroy, 1818
Herpestes edwardsi lanka Wroughton, 1915

Measurements of the skulls of each subspecies were tabulated separately but there are no significant differences between them (Table 1).

At the present day each subspecies occupies a geographically distinct region of India. *H. edwardsi lanka* is confined to Ceylon and *H. edwardsi edwardsi* to the South of India. *H. edwardsi nyula* is found in North East India from Nepal to Assam, north of the Ganges. *H. edwardsi ferrugineus* is found today in the desert regions of North West India, in the Indus valley and eastwards into Rajputana, which is north of Gujarat, so it is likely that the Langhnaj Mongoose belongs to this subspecies.

CONCLUSION

Specific identification of an animal that is known to belong to one of a group of closely related species can be successfully attempted only if it can be compared in structure and dimensions with a series of comparative specimens. This series should contain as many examples as possible of known sex, age and locality. Identification of the Langhnaj Mongoose as *Herpestes edwardsi* has been made possible by the presence of the valuable series of skulls in the British Museum (Nat. Hist.). It is, however, only too seldom that such a collection exists, and even in this case the lack of further mongoose material from Langhnaj permits the possibility of error due to the difficulty of distinguishing individual variations from specific characters in a single specimen.

I am greatly indebted to Professor F. E. Zeuner for the help and guidance that he has given me, and to Dr. F. C. Fraser and Miss J. E. King of the British Museum (Nat. Hist.) for the facilities they have offered me during the course of this work.

TABLE 1

	Length of Lower Jaw in mms. (i)††	Height of Vertical Ramus in mms. (ii)††	Height of Horizontal Ramus in mms. (iii)††	Length of Lower Tooth Row in mms. (iv)††	Length of Upper Tooth Row in mms. (v)††	Height of the Maxilla below the Orbit in mms. (vi)††
Herpestes vitticollis Eight specimens	Mean = 69·64 S.D. 2·58 Range 66·25-73·85	Mean = 26·98 S.D. 0·99 Range 25·55-27·85	Mean = 10·90 S.D. 2·66 Range 9·40-11·65	Mean = 46·60 S.D. 1·46 Range 43·60-48·60	Mean = 45·73 S.D. 1·16 Range 44·70-47·80	Mean = 10·21 S.D. 0·99 Range 9·50-11·70
Herpestes urva, male One specimen	61·15	22·05	9·50	42·45	41·90	10·00
Herpestes auropunctatus Nine specimens	Mean = 36·30 S.D. 1·91 Range 33·40-39·25	Mean = 14·49 S.D. 1·05 Range 12·70-15·80	Mean = 5·66 S.D. 0·19 Range 4·80-6·45	Mean = 24·17 S.D. 0·89 Range 23·15-25·65	Mean = 23·61 S.D. 1·00 Range 22·50-24·90	Mean = 5·10 S.D. 0·17 Range 4·40-6·0
H. fuscus fuscus Five specimens	Mean = 56·69 S.D. 2·87 Range 52·95-59·95	Mean = 22·06 S.D. 1·63 Range 20·00-24·00	Mean = 8·86 S.D. 1·98 Range 8·30-9·75	Mean = 36·49 S.D. 1·49 Range 34·35-39·30	Mean = 35·97 S.D. 2·50 Range 33·85-39·05	Mean = 8·25 S.D. 0·70 Range 7·60-9·10
H. edwardsi edwardsi	Five specimens Mean = 51·39 S.D. 2·14 Range 47·70-53·05	Five specimens Mean = 20·65 S.D. 1·09 Range 18·90-21·70	Five specimens Mean = 7·49 S.D. 0·21 Range 6·95-8·10	Five specimens Mean = 32·64 S.D. 1·31 Range 30·50-33·50	Eight specimens Mean = 32·64 S.D. 1·35 Range 30·35-34·35	Eight specimens Mean = 7·24 S.D. 0·22 Range 6·55-8·00
H. edwardsi ferrugineus Fifteen specimens	Mean = 48·18 S.D. 2·44 Range 45·00-52·90	Mean = 18·70 S.D. 1·07 Range 17·20-21·05	Mean = 7·31 S.D. 0·22 Range 6·45-8·45	Mean = 31·47 S.D. 1·17 Range 29·25-33·95	Mean = 30·78 S.D. 1·20 Range 28·55-32·40	Mean = 6·68 S.D. 0·21 Range 5·95-7·65
LANGHNAJ specimen	53·60	21·05	8·60	33·95	33·00	8·25
H. edwardsi nyula Five specimens	Mean = 47·00 S.D. 3·22 Range 43·60-51·85	Mean = 18·61 S.D. 1·77 Range 18·25-20·45	Mean = 6·89 S.D. 0·89 Range 6·35-8·30	Mean = 6·89 S.D. 1·32 Range 30·00-33·35	Mean = 30·57 S.D. 1·04 Range 29·55-32·65	Mean = 6·39 S.D. 0·22 Range 5·60-7·10
H. smithi smithi smithi Twelve specimens	Mean = 55·02 S.D. 2·30 Range 51·50-59·05	Mean = 21·57 S.D. 1·31 Range 19·80-23·35	Mean = 8·20 S.D. 1·06 Range 6·85-9·65	Mean = 35·61 S.D. 1·08 Range 33·70-37·50	Mean = 35·23 S.D. 1·40 Range 33·05-37·20	Mean = 7·30 S.D. 0·51 Range 6·20-8·10

**Note* : S.D. — Standard deviation. †† Roman numerals refer to measurements depicted in Figure 3A p. 4.

Table I— Linear measurements of the jaws of the six Recent mongoose species that occur in India. From the collection of the British Museum (Nat. Hist.)

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II

PLANT ECONOMY IN ANCIENT NAVDATOLI-MAHESHWAR

By
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PLANT ECONOMY IN ANCIENT NAVDATOLI-MAHESHWAR

By

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INTRODUCTION

The meagre information so far known of the plant economy in ancient India comprises Wheat, Barley and fruit stones of Datepalm from Mohenjo-Daro (MARSHALL 1931, LUTHRA 1936, KOHLI 1934); Wheat and Barley from Harappa; Wheat, Barley, Rice, Peas, Sesamum, Melon seeds and Datepalm from Khokhrakot in Rohtak (VATS 1940; SAHNI 1936, 1938) and Rice from Hastinapur (CHOWDHURY and GHOSH 1955); and Wheat, Bajri, Gram, Nagli, Wal, Lang, Coriander, Jowar, Vatana, (Matar), Kardai, Kodra from Nevasa (SANKALIA *et al* 1960) and Rice from Kolhapur (SANKALIA and DIKSHIT).

Owing to the paucity of finds and the scarce material, the material has hardly been adequately and systematically described. Nevertheless two sub-spp, *T. vulgare* and *T. compactum*, of *Triticum sativum* and the naked barley, *Hordeum vulgare* var. *nudum* from Mohenjo-Daro (LUTHRA 1936); *Triticum compactum* or *sphaerococcum*, *Hordeum vulgare* var. *hexastichon* and *Pisum arvense* from Harappa (VATS 1940); *Oryza sativa* var. *plena* from Khokhrakot, Rohtak (SAHNI 1938) and *Oryza sp.* from Hastinapur (CHOWDHURY and GHOSH 1955) have so far been identified. Hardly any attempt has been made to infer any cultural significance from these finds. KOHLI (1934) has, however, pointed out the similarity of one variety of barley from Mohenjo-Daro to that found in some Egyptian tombs. CHOWDHURY and GHOSH (1955) have recently drawn attention to the significance of the study of archaeobotanical material.

It will be too risky to interpret from the scarce archaeobotanical material the absence or the rarity of cultivation in ancient India. Evidences from ancient literature gathered by GODE (1941-1946) show that many of the modern Indian cultivated plants were known to the ancient Indians as early as the beginning of the Christian era; consequently, their cultivation in India must have started much earlier than 2000 years. The scarcity of records for some and the absence of the others might be due to the want

of such factors or circumstances which have been responsible for their preservation in other parts of the world. It is very likely that the climate has been chiefly responsible for their scarcity in India as is believed (HELBAEK 1952, p. 231) that in climatic zones where agriculture is dependent directly on rainfall, cereal grains, when unprotected, will be quickly destroyed either by sprouting or by decay. They will only keep when carbonised and this necessitates their being exposed to heat.

Material and treatment—The Navdatoli-Maheshwar material comprising carbonised cereals, legumes, fruit remains and oil seeds, constitutes the first important comprehensive collection ever discovered in India. It presents a great variety of plant remains suggesting a large choice and the intensity of cultivation. The material is also helpful in building up the cultural contacts of the ancient Indians at Navdatoli-Maheshwar.

The material, comprising nine selected samples, was at first kindly sent to the Institute by Prof. H. D. SANKALIA and was entrusted to me for investigation by the Director. Later Prof. SANKALIA kindly placed the entire collection at my disposal, the examination of which revealed some additional types. The carbonised grains had already been segregated from the debris and provisionally sorted out as far as they could be identified with their local names. A critical examination has shown that many of the identifications with the local names are correct, except in the case of peas. Flax identified as til or linseed is found to be linseed. The specimens referred to Wheat are found to belong to *Triticum compactum* — *vulgare* type. The seeds of gram (*Cicer arietinum*) are not found in the collection though Prof. SANKALIA mentions them in the list of plants cultivated by the Navdatoli folk (SANKALIA et al, 1958, p. xii). The collection also includes the seeds of some weeds which may have been gathered for food. The absence of the debris precludes the possibility of knowing many other weeds which might have grown in the cultivated fields at Navdatoli-Maheshwar.

Together with the identification and the description of each species, its modern distribution in India and abroad and the ancient records whereever known are also given. The phytogeographical, morphological and cytological studies of the cultivated plants have led many a worker to postulate theories regarding the centres of origin of the cultivated plants. Necessary information regarding various views about the origin of the identified plant spp. is also given.

Age—The Navdatoli finds belong to the Chalcolithic period and range in age from 1500 B.C. to 1000 B.C. Giving an account of the

hearths and houses of the Navdatoli folk, Prof. SANKALIA writes that the houses were burnt down, at least twice, by fire, and the fresh habitation started on the burnt debris (SANKALIA et al, loc. cit.). From the painted pottery types and designs, the technique of mass production of blades and the steatite and the faience beads, SANKALIA et al (loc. cit.) conclude that there was eastward spread of the Neolithic, Bronze, Copper or the Chalcolithic cultures from Iran and other westward countries in Western Asia. The archaeological material further suggests the cultural influences from the Northern and the Southern neighbours.

DESCRIPTION OF THE PLANT REMAINS

A. *Cereal Grains*

1. WHEAT

Wheat in the collection is represented only by the carbonised grains: the spikelets and the ears are altogether absent; carbonised stalks are, however, present in some samples viz., 13638, Md IV; 8, I A6; Ph. II. Charcoal fragments of the diameter of wheat stems are also seen in some samples.

The grains of wheat are present in almost all the samples and the frequency of wheat varies from sample to sample. In the samples examined wheat has been found to be rare or of low frequency in a collection of legumes and vice-versa.

Pure collection of wheat has been seen in some samples belonging to Ph. III (1199, 1251, 2890, 2892, 5368, 10013, 11541, 11537, 11743).

On the basis of the shape and size of the grains, the following spp. of *Triticum* are distinguished.

Triticum vulgare-compactum type

(*T. vulgare* Vill., Bread Wheat and *T. compactum* Host, Club Wheat)

(Pl. 1, Fig. 1)

Wheat grains belonging to this type are invariably found in almost all the samples in varying proportions. The grains are short, oblong, grooved and thick with their ends broad and blunt. The dimensions are given below in Table 1.

Based on dimensions, it is possible to distinguish two size groups—small and large.

TABLE 1

DIMENSIONS OF SMALL WHEAT GRAINS

	Average	Min.	Max.
Length in mm. ...	4.6	3.9	5.3
Breadth in mm. ...	2.9	2.3	3.6
Thickness in mm. ...	2.7	2.1	3.3
L/B ...	1.5	1.6	1.4
L/T ...	1.6	1.8	1.5
B:L. Index per cent. ...	63	58	68
T:B. Index per cent. ...	93	91	91

TABLE 2

DIMENSIONS OF LARGE WHEAT GRAINS

	Average	Min.	Max.
Length in mm. ...	5.5	5.1	6.2
Breadth in mm. ...	3.6	3.3	4.0
Thickness in mm. ...	2.6	2.0	3.1
L/B ...	1.5	1.3	1.7
L/T ...	2.0	1.7	2.6
B:L. Index per cent. ...	65	64	64
T:B. Index per cent. ...	72	60	77

Wheat is predominantly cultivated in the plains of North India—in the Punjab and Uttar Pradesh and is less intensively cultivated in Bombay and Madhya Pradesh.

The short and broad grains with broad and blunt ends compare very closely with the grains of *T. vulgare-compactum* type and are easily distinguishable from those of the other species of Wheat such as Spelt and Emmer. Besides, the B:L and T:B indices (HELBAEK 1952, 1957, 1958) are further helpful in distinguishing the *vulgare-compactum* type from Emmer.

The L:B ratio of modern and subfossil grains of both *T. vulgare* and *T. compactum* fluctuates about 1 : 9 (PERCIVAL 1921; JESSEN and HELBAEK 1944). The L:B ratio of the Navdatoli grains is 1:5. Short and broad subfossil wheat grains with L:B ratio ranging from 1:3—1:5 have, however, been attributed to two varieties of *T. compactum*, *T. compactum var. antiquorum* or *var. muticum* Heer and *var. globiforme* Buschan (SCHIEMANN, 1932) and are described from Denmark (ROSTRUP 1877), Great Britain (JESSEN and HELBAEK, loc. cit.), Italy and Switzerland (HEER 1865; NEUWEILER 1935, 1946) and Palestine (HELBAEK 1958).

PERCIVAL (1921) believes that the short and broad grains resemble most closely those of *T. sphaerococcum* Perc. which is known only from India and considers this species as the extinct form of *T. compactum*. Further he (PERCIVAL, loc. cit.) looks upon T. *sphaerococcum* a hexaploid like *vulgare* and *compactum* as a modern analogous form within the South Eastern part of the range of *vulgare*, while *compactum* is confined to the North Western part of this range.

VAVILOV (1950) considers the central Asiatic centre comprising the Punjab, Kashmir, W. Pakistan (NWFP), Afghanistan and Soviet Republics of Tajikstan and Uzbekistan and West Tian Shan as the original home for *T. compactum, vulgare* and *sphaerococcum*.

Triticum sp.

In some samples a few grains of wheat with pointed ends different from those of blunt-ended grains of *T. vulgare-compactum* type are seen. These grains are larger than the large-grained *T. vulgare-compactum* type.

The dimensions are given below:

TABLE 3

DIMENSIONS OF WHEAT GRAINS

	Average	Min.	Max.
Length in mm. ...	6.3	6.1	6.8
Breadth in mm. ...	3.9	3.7	4.0
Thickness in mm. ...	3.1	2.5	3.9
L/B ...	1.6	1.5	1.7
L/T ...	1.9	1.4	2.4
B: L. Index per cent ...	61	60	58
T: B. Index per cent ...	79	67	97

These grains approach the grains of Spelt in shape only but are far removed from them in their L/B and T/B ratios which compare with those of *Triticum vulgare-compactum* type.

2. Rice

The grains of rice are of less frequent occurrence than those of wheat, entirely absent in Phase I but present in Phases II-IV. The exclusive collection of rice has been found in samples 2180, Ph. III and 14200 in Ph. IV. Mixed with the other cereals and legumes a very low frequency of rice is seen. The following single species of rice has so far been identified.

Oryza sativa L.

(Pl. 1, Fig. 2; Text-fig. 1)

The grains of rice are oblong, flattened on the sides and strongly ribbed. The long hilum is preserved in many seeds. The dimensions are given below in Table 4.

TABLE 4

Dimensions of Rice grains

	Average	Min.	Max.
Length in mm. ...	4.7	4.3	5.1
Breadth in mm. ...	2.2	2.0	2.4
Thickness in mm. ...	1.5	1.2	1.8
L : B in mm. ...	2.1	2.1	2.2
T : B in mm. ...	0.68	0.60	0.75

Oryza sativa, the only cultivated species in India, occurs wild in the marshes of Rajputana, Sikkim, Bengal, Khasia Hills, Central India and Circars. It is widely cultivated in India mainly in the Eastern part of India including the Brahmaputra Valley, the Ganges delta, the middle Ganges plains, the Chattisgarh plains and the east coastal deltas of the Mahanadi, Godavari, Krishna and Kavery. The Western limit is determined by 140—isohyetal line. Outside the main rice growing area, it is cultivated in the Doon Valley, Kashmir, and in the West Coast plains extending northward as far as the Gangetic plains.

Two subspecies, *japonica* and *indica*, comprising all the varieties of *O. sativa* are recognized. The subspecies *indica*, the long-grained rice, is believed to have originated in India, while the subspecies *japonica*—the short-grained rice, is believed to have originated in Japan. From his studies of ecotypes of rice in Nepal, Himada (1956, p. 311) concludes that the rice of the subtropical region shows the general characteristics of *indica* type, while that of the temperate region displays the common characteristics of *japonica* type.

HIMADA (loc. cit.) has established an accessible model or standard for the *japonica* and *indica* types from the primitive varieties grown in Japan, Korea and Ryuku for *japonica* type and those from India, Ceylon and Southern China for the *indica* type. Based on the characters of spikelets, seedling and mature rice plants, he has been able to establish the ecotypes besides some intermediates. He looks upon the Japanese red long and Japanese red short as the standards for *indica* and *japonica* respectively. Taking together the Japanese red long and Korean red long as standard for *indica*, and Japanese red short and Korean red short as a standard for *japonica* and comparing the dimensions of Navdatoli grains with these standards (Text fig. 1), we find that the Navdatoli grains neither belong to *indica* nor to *japonica* type but possess characters of both the types suggesting hybrid nature of the Navdatoli grains.

ROSCHEIVICZ (1931) derives the origin of *O. sativa* from *O. sativa L. spontanea* (*O. sativa fatua* Chav.) since the latter resembles very much cultivated rice and moreover is found in places of most ancient and intensive rice cultivation in Asia, Indochina and North Australia. This leads him to believe that the cultivated rice first arose in Asia, namely India and Indochina.

According to VAVILOV (1931) the original home of rice is located in India proper including the Valley of the Ganges, the whole of Indian Peninsula and adjoining parts of Indochina and Siam. He further writes that "here it is still possible to observe rice in its primary stage as a wild plant, as a weed in the fields, and to follow its development into the primitive cultivated forms, which display an astonishing variety."

Later, in 1950 VAVILOV further stresses India as the home of rice. Describing the Indian centre of origin he excludes the N. W. India, Punjab and West Pakistan but extends the centre to Assam and Burma. He considers this centre as the second in importance and in geographic order.

The centre of origin of rice outlined by CHATTERJI (1951), extends from the eastern border of Nepal through East Pakistan, Assam, Burma, Thailand, Indochina, Southern China, Indonesia, the Phillipines to Formosa.

The only divergent view that the original home of rice might be in Africa is mentioned by Cobley (1956). According to him the warmer parts of Asia and parts of South America may have seen its evolution.

B. *Legumes*

1. Lentil

The grains of Lentil have in all samples been found mixed with the grains of cereals and legumes and the pure collection of *Lens* has only been seen in Sample 1715, Ph. III. In its varying proportions it occurs in all the Phases.

Lens culinaris Medikus

(*Lens esculenta* Moench.)

(Pl. 2, Fig. 1)

The grains of Lentil, about 2.2—3.1 mm in diameter and about 1.8—2 mm thick, are lenticular in shape with the keeled edge preserved in many of them. The seed-coat and the hilum scar are not preserved.

No record of the proto or prehistoric lentil has so far been found in India yet. The records from abroad include seeds from the Predynastic tombs in Egypt (Brunton, 1948; Lauer et al, 1950) suggesting great antiquity of lentil in Egypt. Lentil is also known from the Neolithic in Hungary, Switzerland and Germany (Buschan, 1895; Neuweiler, 1905, 1946).

Lentil, a cold weather crop, is of rare cultivation in South India and is largely cultivated in Northern and Central India and the foothills of the Himalayas. It is also cultivated in Central and Western Asia, on the Mediterranean coast and in Southern Europe.

De Candolle considers its origin in S. E. Europe and in temperate Asia, where according to him it has been cultivated since the prehistoric times. He (De Candolle, loc. cit.) further believes that Lentil was unknown in India before the invasion of Sanskrit-speaking people.

Vavilov (1950) proposes four centres of origin for Lentil, viz., the Central Asiatic centre, the Near Eastern centre, the Mediterranean region and the Abyssinian centre extending from N.W. India, Kashmir, N.W. Pakistan, Afghanistan and Soviet Republics of Tajikstan, Uzbekistan, and West Tian Shan, the interior of Asia Minor, the whole of Transcaucasia, Iran and highlands of Turkmenistan, the Mediterranean region extending to Abyssinia, Eritrea and Somaliland.

Helbaek (1958) looks upon the Anatolian[1]—Caucasian region as the centre of origin for Lentil from where it spread to Europe at an early date.

2. Black Gram (Urd)

Phaseolus[2] *mungo* L.

(Pl. 2, Fig. 2)

The square or oblong seeds with a pronounced concave hilum scar are about 3.5—4.7 mm long, 2.5—3 mm broad and 0.5—75 mm thick. The seeds resemble very much the black or dark brown-seeded variety.

It is largely cultivated in the North and is of rare or of less intensive cultivation in South India.

I am not aware of any proto-or prehistoric records outside India.

Prain (1898) derives *P. mungo* and *P. radiatus* from *P. sublobatus* Roxb. a wild species distributed in U. P., Bihar, Rajputana, Konkan and Ceylon and also in Arracan.

The Hindustan centre comprising India (excluding NW India), East Pakistan, and Burma is considered by Vavilov (1950) as the primary home of black gram, while the region extending from NW India, NW Pakistan, Kashmir, Afghanistan, Soviet Republics of Tajikstan, Uzbekistan and Western Tian Shan constituting the Asiatic centre is looked upon by Vavilov (loc. cit.) as the secondary home.

3. Green Gram (Mung)

Phaseolus radiatus L.

(Pl. 2, Fig. 3)

The square to roundish seeds smaller than those of ' Urd ' measure about 2.5—3.0 mm in length, about 1.8—2.2 mm in breadth and about 1.5—2 mm in thickness. A tiny hilum scar is noticeable on the somewhat raised ridge in many of them.

'Mung' is extensively grown all over India and throughout tropics of the old world. It is believed to be native in India, although some of the varieties (viz., Var. *grandis*) are known to be introduced from China.

1 This now gets additional confirmation from the discovery of lentil (in Level VI from bottom) at Hacilar, in Turkey and dated to 5590 ± 180 B.C. by radiocarbon. *Illustrated London News*, April 8, 1961, p. 588. (H. D. S.)

2 Great confusion exists about the nomenclature of the spp. of *Phaseolus*. The nomenclature adopted here is from Prain 1898, p. 423, *J. Asiatic Soc. Bengal*. The varieties are not taken into consideration.

There is no mention of this species in the centres of origin for cultivated plants by VAVILOV (1950). According to KITAMURA (1956, p. 122) the type locality for 'mung' is Canton, China.

If PRAIN is right in deriving 'mung' from *P. sublobatus* Roxb. a wild species, then its origin may be safely attributed to the Hindustan centre of VAVILOV (loc. cit.).

4. GRASS PEA

Lathyrus sativus L.

(Pl. 1, Fig. 4)

The seeds are very much compressed and wedge-shaped with the small hilum placed on one side of the thick end. The seeds are of variable sizes.

Grass pea is extensively cultivated as a cold weather crop throughout India and on the Himalayas upto 4000 ft. above sea level. It is also used as a fodder.

Numerous records ranging in age from the Neolithic to the Iron Age are known outside India from Hungary, Switzerland, Rome, Turkey, Egypt, Palestine, Iraq etc. (BUSCHAN 1895; HELBAEK 1954, 1956, 1958). HELBAEK (1956, p. 292) writes that this plant was of wide distribution in the third millenium B.C.

Its centre of origin according to VAVILOV (1950) more or less coincides with that of Lentil, excluding the Near Eastern centre.

Leguminous weeds

Mixed with the various legumes and in other collections, several spherical or compressed seeds each with a hilum scar ranging in shape from circular to short or long slit-like have been seen. These grains range in size from 2—4 mm. These seem to be the seeds of the weeds. From the nature of the samples it appears that they were not deliberately cultivated, but were gathered for food. Their occurrence in Wheat and the pulses probably suggests that they were accidentally reaped together with the host crop. The possibility that some of them may have been actually domesticated plants can hardly be overlooked.

On the basis of the shape, size, and the nature of the scar, the seeds of the following spp. have so far been identified.

Pisum arvense (Pl. 1, Fig. 3)
Lathyrus sphaericus
Vicia sativa
V. tetrasperma

The identification of the above cannot be taken to be final since the material of all the Indian spp. of these genera was not available for a comparative study. Besides the above plant spp., there seems to be a possibility of identifying some more spp. at a later date.

Owing to the tentative identification of these spp. it does not seem desirable to enter into any considerations of their origin and distribution. It may, nevertheless, be pointed out that *Pisum arvense* is a cold weather spp. and is largely grown as a crop in some parts of N. India.

5. LATHYRUS sp.

The grains are spherical, about 2.7—4 mm in diameter, with a prominent hilum scar. The seeds resemble in shape those of *Pisum sativum* but are very small in size.

C. *Oil Seeds*

1. LINSEED

All the samples of carbonised linseed so far examined belong to Phases I, III & IV and are the pure collections of Linseed.

Linum usitatissimum L.
(Pl. 2, Fig. 4)

The seeds are well preserved with a distinct beak at the micropylar end. The seeds are about 3.5—4.88 mm long and 2.1—2.4 mm broad.

Linseed is extensively cultivated in India for its seeds to extract oil but not for flax. It is distributed westwards to the Atlantic.

There are numerous records of proto and prehistoric linseed from abroad: from the Neolithic to the Viking period in Great Britain, from Neolithic and Bronze Age in Switzerland, from Bronze Age in Holland, Post-Roman Age in Denmark and N. Germany (JESSEN and HELBAEK 1944; HELBAEK 1953; GODWIN 1956; VISHNU-MITTRE 1959).

From a recent appraisal of sub-fossil flax from various countries in Europe, HELBAEK has been able to study the successive extension of *Linum*

culture or flax culture in Europe. He concludes that the flax culture spread in the Western Europe since the Neolithic times but it did not reach the Northern and Central Europe until during the Iron Age, while it reached Denmark until after the end of the Roman age.

The centre of origin of Linseed according to VAVILOV (1950) is in the Near East, Mediterranean and the Abyssinian region extending from the Asia Minor, Transcaucasia, Iran, the highlands of Turkmenistan, the Mediterranean and Abyssinia, Eritrea to Somaliland. VAVILOV (loc. cit.) further writes that the group prostratum Vav. is endemic in Asia and the large-seeded subspecies *mediterranean* Vav. is found in the Mediterranean.

Outside India flax is cultivated for seed in Abyssinia, Eritrea and Somaliland.

D. *Fruit Remains*

1. INDIAN JUJUBE (Ber)

In extremely low proportions the stones of Jujube are found mixed in numerous samples while the first large collection has been seen only in sample 11608 Ph. III.

Zizyphus jujuba Lamk.
(Pl. 2, Fig. 5)

The fruit stones, 6.7—8 x 6—8.7 mm are globose or ovoid in shape with rugose surface. The stones are 1-3-celled.

The species is extensively cultivated throughout India from the base of Himalayas to Ceylon and Malaccas. It is not truly wild in India and is seen profusely around former villages or native settlements. It grows abundantly in Khandesh jungles in Bombay. Outside India the species is widely distributed in W. Pakistan, Afghanistan, Arabia, Egypt, Tropical Africa, Malay Archipelago, China and Australia.

I am not aware of any proto or prehistoric records outside India.

No mention is made of its origin by VAVILOV (loc. cit.). DE CANDOLLE (1959) believes it to be of Indian origin. Based on the philological grounds, DE CANDOLLE believes its extension and naturalization in the east in recent times and that its introduction to Arabia and Egypt took place at a yet later date.

2. Myrobalan

Phyllanthus emblica L.

Only one complete fruitstone was discovered which being very fragile broke into 2-seeded coccii, each about 12 mm long and about 10 mm broad in the middle. The fruitstone was six-lobed and globose. The seeds, 5 x 3 mm, are trigonous. There are only two records of it and both are from Ph. III, S. Nos. 2011 & 2012.

This occurs both cultivated and wild in the tropical and subtropical parts of India, chiefly in the dry deciduous forests ascending to 4500 ft. in Himalayas. Outside it occurs in Ceylon, Burma, the Malaya Islands and China.

Its home is believed to be the Indian Centre including Burma and Assam but excluding NW India.

To the best of my knowledge no proto- or prehistoric records are so far known from elsewhere.

3. Unidentified Fruit Type

In the Navdatoli-Maheshwar collection there are also found some large fruits. The fruits are oblong compressed in shape with narrow and round ends, one of them bears a well marked deep hole. The fruits are flattened with a rind about 1 mm thick. The surface in some is eroded in others smooth while in one of the uneroded ones a $\pm$ reticulate pattern of ridged muri is seen. The seed bears a suture all along its edge which suggests the mode of dehiscence which was probably lateral.

The seeds range in size from about 14-20 mm in length, 6-11 mm in breadth and 4-7 mm in thickness. They are only known from Phases II and III.

Discussion and Conclusion

The Navdatoli-Maheshwar material comprising the remains of cereals, legumes, oil seeds and fruits provides the first comprehensive record of ancient plant economy in India. The cereals consist of wheat and rice only. Wheat is represented by *Triticum vulgare—compactum* type. A meagre evidence, however, is available of the occurrence of another species of *Triticum* which remains undefined at the moment. Rice is represented by *Oryza sativa* and the grains are intermediate between the long-grained

and the short-grained varieties. The legumes consist of *Lens culinaris*, *Phaseolus mungo*, *P. radiatus*, *Lathyrus sativus* and some weeds such as *Pisum arvense*, *Lathyrus sphaericus*, *Vicia sativa* and *Vicia tetrasperma*. The oil-seeds are represented by *Linum usitatissimum* and the fruit remains by *Zizyphus jujuba*, *Phyllanthus emblica* and an unidentified type. With the exception of rice and wheat, all the other plant remains are known for the first time to have been cultivated or used in ancient India.

The absence of barley, oats, *Pennisetum typhoides*, *Andropogon sorghum*, *Cicer arietinum* and *Pisum sativum* is quite significant and probably suggests that their introduction into this part of India took place in the Post-Chalcolithic period.

It is interesting to find that the grains of various kinds are found mixed together in various proportions. It is very difficult to establish whether this mixing was accidental or intentional. Some of the samples containing more or less pure collection of the seeds of weeds suggests that they were gathered intentionally. From this it appears that the Navdatoli-Maheshwar folk practised mixed cultivation and perhaps mixed consumption[1] too. It may be pointed out that the mixed cultivation has been practised till recently in some parts of India and some of the primitive people still practise it.

Amongst weeds, the seeds of *Pisum arvense* are still eaten by poor people in some parts of India. The presence of seeds of *Lathyrus sativus* in the Navdatoli collection is all the more interesting. This species is largely cultivated for fodder. Its seeds possess a poisonous alkaloid and are well-known for causing paralysis. Its seeds are no doubt consumed by the poor people even today but especially in times of scarcity. Very likely its seeds were gathered by the Navdatoli folk for consumption.

From the frequent distribution of *Zizyphus jujuba* in all the samples it appears that it was a common and largely used fruit by the Chalcolithic folk in this area. This leads one to believe that *Zizyphus jujuba* formed a significant member of the vegetation around, one of the other members of which was *Phyllanthus emblica*. The fruit stones of Ber belong to the wild shrubby variety which is fairly gregarious. It is difficult to understand what purpose was served by storing the fruit-stones of this species if this wild species was very common around.

1 Almost all the collections were made from the floors of destroyed or burnt down habitations, and so there is a chance of things getting mixed up. So this inference is perhaps not justified. (H.D.S.)

Climatic significance—Considering the climatic requirements of the plant spp. from Navdatoli-Maheshwar, it is found that there is a mixture of Tropical, Subtropical and cold weather plant spp. In these the cold weather spp. outnumber the others viz., wheat, *Lens culinaris*, *Lathyrus sativus*, *Linum usitatissimum*, *Pisum arvense*, *Lathyrus sphaericus*, *Vicia sativa* and *Vicia tetrasperma*. From their present day distribution it appears that these cold weather crops are of rare or less intense cultivation in the region where the sub-fossils have been found. One is, therefore, led to believe, though tentatively, that the cold season in this region in the past might have been comparatively cooler than at present.

Stratigraphical and archaeobotanical correlation—The carbonised grains are distributed over Phases I-IV. From the frequency of the records of the plant remains in the respective Phases a comparative estimate is made of the consumption of the cereals, legumes and the fruits by the prehistoric people at Navdatoli-Maheshwar. Agricultural activity seems to have been intense during the Phases II and III than in I & IV. While wheat has been in use throughout all the Phases, Rice was introduced during Phase II only. Except Urd (*Ph. mungo*) which is absent in Phase IV, the other legumes are all present throughout the four Phases.

Linseed is absent in Phase II only and its records increase four times from Phases I-IV.

Ber seems to have been a common fruit throughout all the Phases and has been comparatively more common in Phase II. The unidentified fruit type appears only in Phases II and III and Amla in Phase III only.

An attempt has been made to find out the relative proportion of the cereals and important legumes from the frequency of their records in all the Phases. The graph for the cereals shows a gradual decline of Wheat from Phases I—IV, which is more marked in Phase IV, while Rice, appearing in Ph. II, shows a gradual rise with a conspicuous increase in Phase IV.

The graph for the legumes shows gradual decline to low values during Phases I—IV in *Lens culinaris*, *Phaseolus radiatus* and *P. mungo*. The latter is absent in Ph. IV. *Lathyrus sativus* shows a decline in Phase II and then ascending values in Ph. III and considerably high values in Ph. IV during which all the other legumes register very low values.

Cultural significance—Considering the proposed centres of origin for the identified species of the cultivated plants, it appears that the centre

of origin of *Lens culinaris, Lathyrus sativus* and *Linum usitatissimum* lies either outside India or extends from NW India, Soviet Republics of Tajikstan, Uzbekistan and West Tian Shan, Transcaucasia, Iran, Turmenistan, the Mediterranean region of Abyssinia, Eritrea and Somaliland. The occurrence of these cultivated plants and of wheat with the original home in Punjab, Kashmir, W. Pakistan, Afghanistan, Soviet Republics of Tajikstan and Uzbekistan and in the SW far away from original home indicates the eastward spread of the Chalcolithic cultures from Western Asia. This conclusion based purely on the archaeobotanical material is in accord with the conclusion derived from the painted pottery types and designs, the metallic remains, the steatite and the faience beads and the technique of mass production of blades at Navdatoli, which offer as "parallels between India and West Asia" (SANKALIA et al, 1958).

The modern distribution of wild rice and the consensus of opinion regarding its origin suggest that Northern, Central and Eastern India, Burma, Malaya etc. constitute the home of *Oryza sativa*. The hybrid nature of the Navdatoli rice and its introduction during the later part of Chalcolithic period probably suggest that rice must have been introduced at Navdatoli-Maheshwar from North or East and the cultural contacts of Navdatoli with some sites towards North such as Nagda and Malwa sites (SANKALIA *et al* 1958, p. 244) do corroborate the above conclusion, though a great caution needs be exercised in dealing with the origin and spread of rice culture in India. Particularly in view of the fact that still earlier records of rice are now reported from Lothal and Rangpur in Saurashtra (Ghosh, 1961).

History of Indian cultivated plants

The various methods used for tracing the history of the cultivated plants comprise the historical, the phyletic and the archaeo-botanical, of which the latter is believed to provide a surer basis. Many of the cultivated plant spp. have been known to the Sanskrit-speaking people in India suggesting their antiquity. This conclusion is further supported by the occurrence of numerous names for the cultivated plants in modern Indian languages. It is a pity that so far the Vedic, Mahabharata and the Ramayana epics and the Puranic periods of Sanskrit-speaking people have not been identified with the well-known archaeological periods in India and any evidence obtained from the Sanskrit literature cannot be considered chronologically. Some conservative estimates of date have been, however, assigned to these periods, but the evidence for these from the corresponding archaeological periods has been lacking so far; until that is achieved we shall have

to depend upon the archaeo-botanical data for throwing light on the history of the cultivated plants in India.

The earliest records of the cultivated plants come from the Indus civilization (Mohenjodaro and Harappa) which is estimated to be of 1500 B.C.—2500 B.C. in age. This culture existed in Sind, the Punjab and the Northern part of Rajputana as well as Kutch, Saurashtra, coastal Gujarat. Wheat, Barley and Datepalm constitute the only evidence of the cultivated plants.

The Harappa Culture is followed by the Chalcolithic culture (400 B.C.—1500 B.C.) which, despite its regional differences, is characterised by a specialized blade industry and the painted pottery. The Chalcolithic culture extended from the Deccan, Central India, Saurashtra, Sind, the Punjab N.W. Frontier Province and Iran. A large collection of the plant remains comprising numerous spp. of cultivated plants has hitherto been obtained from the Narbada Valley in Central India while some evidences have also come forth from Nevasa in the Godavari-Pravara system and from Hastinapur Period II. The bulk of remains of the cultivated plants from Navdatoli-Maheshwar in Central India are believed to be representative of the cultivated plants of the Chalcolithic period. By comparison it seems that the evidence of the cultivated plants from Harappa culture is insufficient and meagre and any conclusions drawn from the absence in it of a large number of spp. that are found in the Chalcolithic period is likely to turn out as misleading when more material is discovered from the Harappa culture. It is, therefore, that the historical comments here are largely restricted to the plant spp. found in the Harappan culture.

Archaeo-botanically speaking the history of Wheat and Barley can be traced as far back as 2500 B.C. Wheat was of the *Triticum vulgare-compactum* type, very likely both the subspp. of *T. sativum* were present. Barley is represented by naked barley—*Hordeum vulgare* var *nudum* and *H. vulgare* var *hexatichon*. But for a picture of what is believed to be *Andropogon sorghum* on Mohenjodaro pottery (No. 5, Pl. LXXXVII, MARSHALL 1931), no other evidence of its occurrence in the Indus civilization is available.

While the cultivation of wheat continued into the Chalcolithic period, the cultivation of barley was probably stopped after the close of Harappan culture. It is interesting to find that it was the same species of wheat that is found both in the Harappan culture and the Chalcolithic period. This probably suggests the evolution of the Chalcolithic culture from that of the Harappan. A vague Harappan influence in the Chalcolithic has been recognized by

many an archaeologist as is evidenced by the commonness of the tradition of painted pottery, copper-bronze, and ribbon-flakes which are the undoubted Harappan features.

From the Post-Chalcolithic period the evidence has come forth of the occurrence of wheat or barley and rice. The examination of the material reveals that both wheat and barley are present.

No evidence of rice has been obtained in the Harappan period* and during the Chalcolithic period it appears somewhat late (Phase II at Navdatoli-Maheshwar) and continues to have been one of the staple elements of food even during the Post-Chalcolithic period as evidenced by its occurrence at Khokhra Kot.

Barley seems to have been reintroduced in India during the Post-Chalcolithic period.

For opportunity to investigate this fascinating material, my thanks are due to Dr. K. R. SURANGE, Director, Birbal Sahni Institute of Palaeobotany, Lucknow, who kindly entrusted the material to me for investigation. This detailed report could not have been possible but for the co-operation of Prof. H. D. SANKALIA who sent me the entire collection together with the stratigraphical information for which I am deeply indebted to him. My thanks are also due to him for showing keen interest in the work and suggesting improvements in the text.

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*However, recently (Ghosh 1961), evidences of the occurrence of rice have been provided from Lothal, Dist. Ahmedabad, Gujarat (about 2300 B. C.), and from Rangpur, Limdi Taluka, Dist. Zalawad, Saurashta (about 2000 B.C.-1500 B.C.). The evidence from Lothal comprises only three impressions of rice spikelate and remnants of husk discovered on clay lumps and in the case of Rangpur material the typical chess board pattern of the outer surface of the husk has been recognised. This evidently tends to extend the history of rice in India into the Harappan period, the southward extension of which is found at Lothal. In view of the modern occurrence of wild rice in the marshes of Rajputana and Central India and their impressions in the lumps of clay which might have been picked up from similar marshes around Lothal, it remains to be established if the archaeobotanical evidence really suggests the cultivation of rice at Lothal and during the Harappan period. The paucity of records of rice from the Chalcolithic period, the nature of the specimens, their preservation and the indeterminable status of the Lothal and Rangpur specimens (whether belonging to the cultivated or wild rice) are probably suggestive of the cultivation of rice during the Post-Harappan period.

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Fig. 1 *Triticum vulgare-compactum* (Wheat)

Fig. 2 *Oryza sativa* L. (Rice)

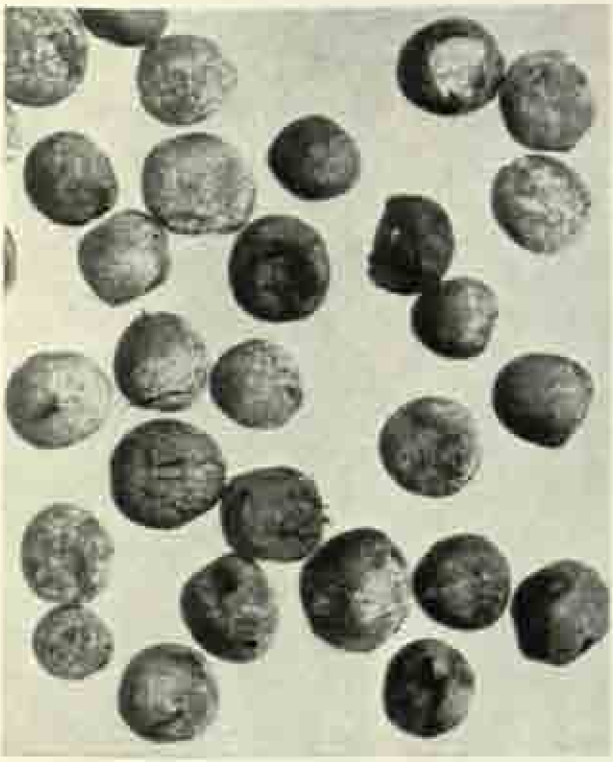


Fig. 3 *Pisum arvense*

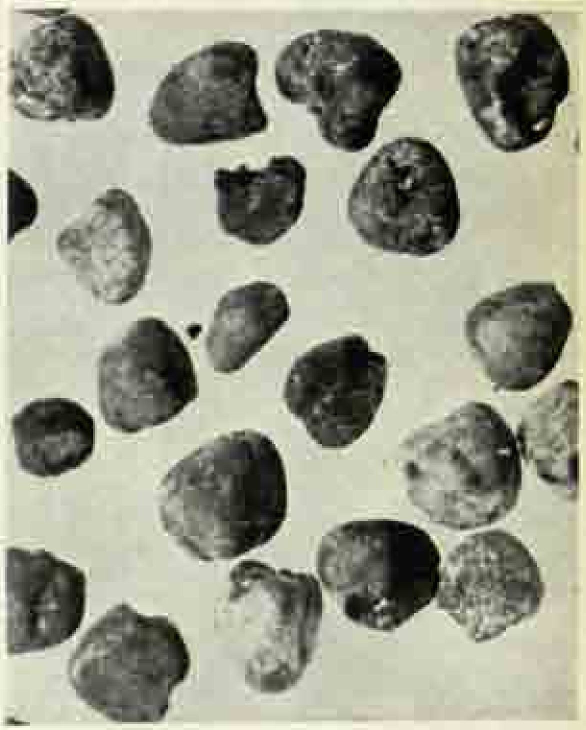


Fig. 4 *Lathyrus sativus* L. (Green Pea)

PLATE 2

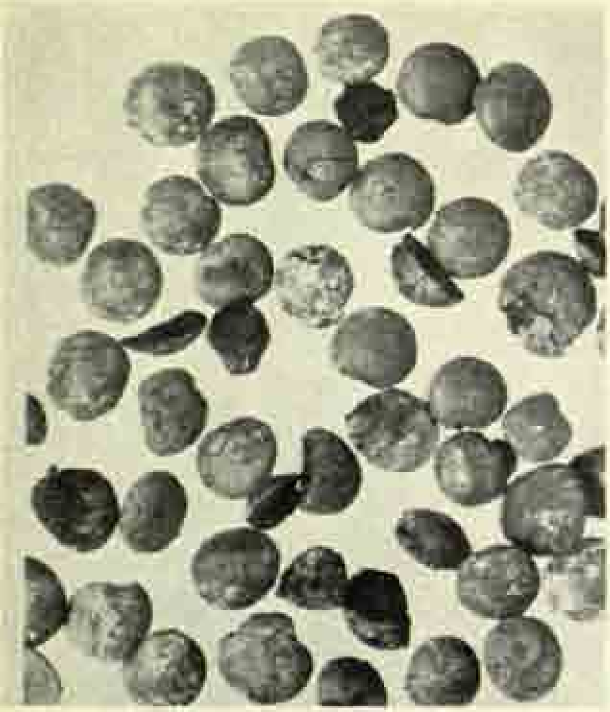


Fig. 1 *Lens culinaris* Medikus (Lentil)

Fig. 2. *Phaseolus mungo* L. (Urd)

Fig. 3 *Phaseolus radiatus* L. (Mung)

Fig. 4 *Linum usitatissimum* L. (Linseed)

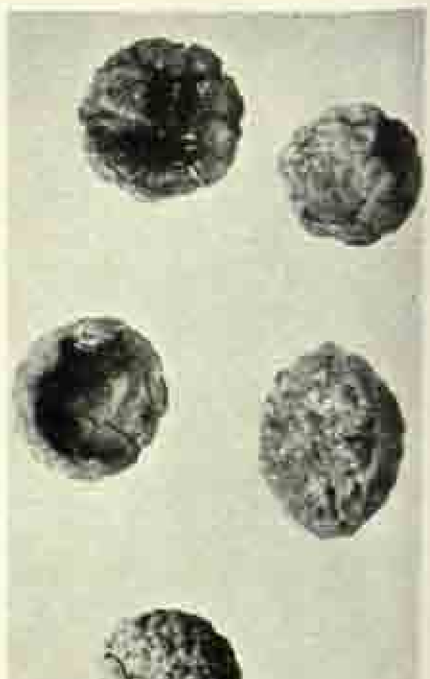


Fig. 5 *Zizyphus jujuba* Lamk (Ber)

EXPLANATION OF PLATES

PLATE 1

Fig. 1. *Triticum vulgare—compactum* type.

Fig. 2. *Oryza sativa* L.

Fig. 3. *Pisum arvense*

Fig. 4. *Lathyrus sativus* L.

PLATE 2

Fig. 1. *Lens culinaris* Medikus

Fig. 2. *Phaseolus mungo* L.

Fig. 3. *Phaseolus radiatus* L.

Fig. 4. *Linum usitatissimum* L.

Fig. 5. *Zizyphus jujuba* Lamk.

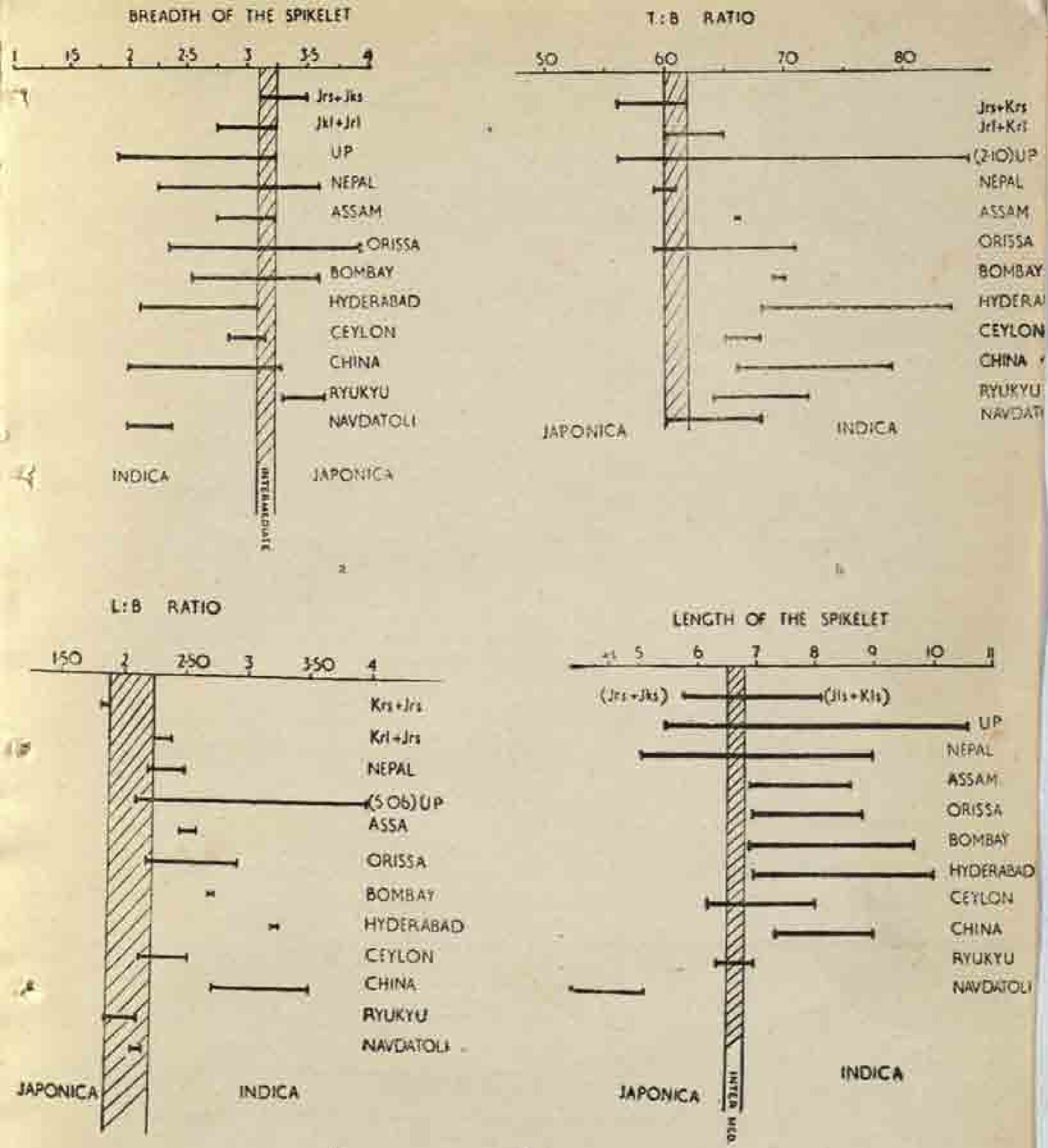
LEGENDS TO TEXT-FIGURES

Text.fig. 1. Comparison of the dimensions of the grains of rice with the standard *indica* and *japonica* types.

Text-fig. 2. Diagram to illustrate for each Phase the percentage proportion of the kinds of cereal grains for examined sites.

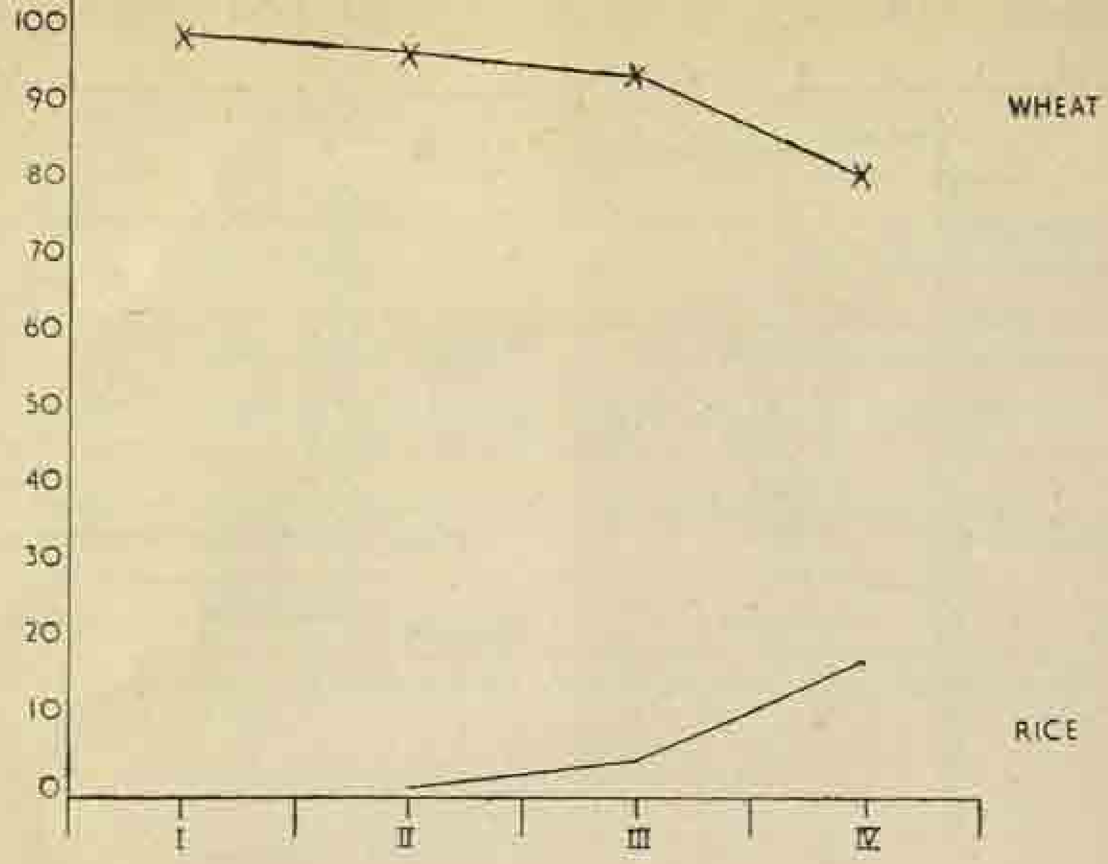
Text-fig. 3. Diagram to illustrate for each Phase the percentage proportion of the main types of legumes of all examined sites.

Text-fig. 4. Map of India showing the comparative distribution of wheat in the Harappan and Chalcolithic periods.
x Harappan sites
† Chalcolithic sites
Dense black line indicating the distribution of wheat during the Harappan period and the broken line indicating the distribution in the Chalcolithic period.



BREADTH OF THE SPIKELET
1 1.5 2 2.5 3 3.5 4
Jrs+Jks
Jkl+Jrl
UP
NEPAL
ASSAM
ORISSA
BOMBAY
HYDERABAD
CEYLON
CHINA
RYUKYU
NAVDATOLI
INDICA
INTERMEDIATE
JAPONICA
a
T:B RATIO
50 60 70 80
Jrs+Krs
Jrl+Krl
(2·10)UP
NEPAL
ASSAM
ORISSA
BOMBAY
CEYLON
CHINA
RYUKYU
JAPONICA
INDICA
b
L:B RATIO
1.50 2 2.50 3 3.50 4
Krs+Jrs
Krl+Jrs
NEPAL
(5.06)UP
ASSA
ORISSA
BOMBAY
HYDERABAD
CEYLON
CHINA
RYUKYU
NAVDATOLI
JAPONICA
INDICA
c
LENGTH OF THE SPIKELET
5 6 7 8 9 10 11
(Jrs+Jks)
(Jls+Kls)
UP
NEPAL
ASSAM
ORISSA
BOMBAY
HYDERABAD
CEYLON
CHINA
RYUKYU
NAVDATOLI
INDICA
JAPONICA
d

Text fig. I



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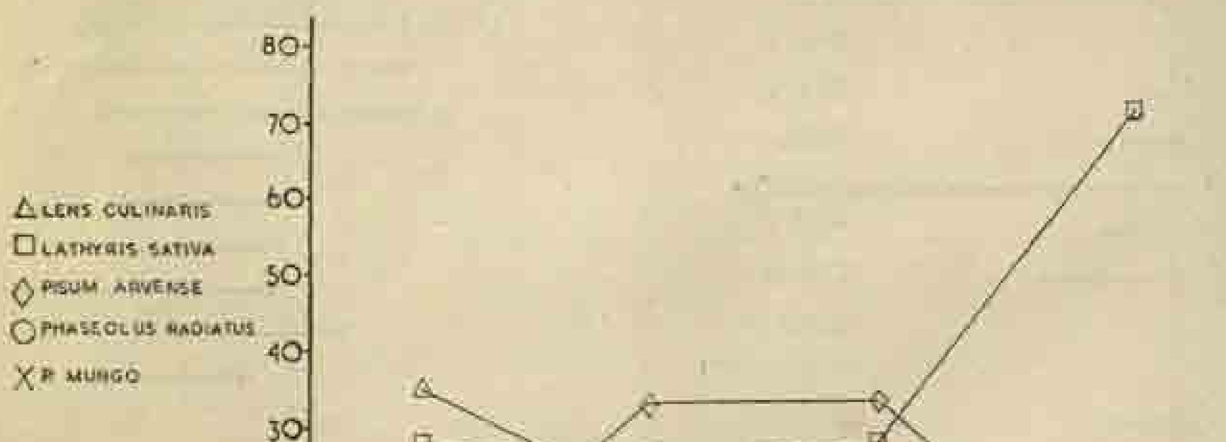

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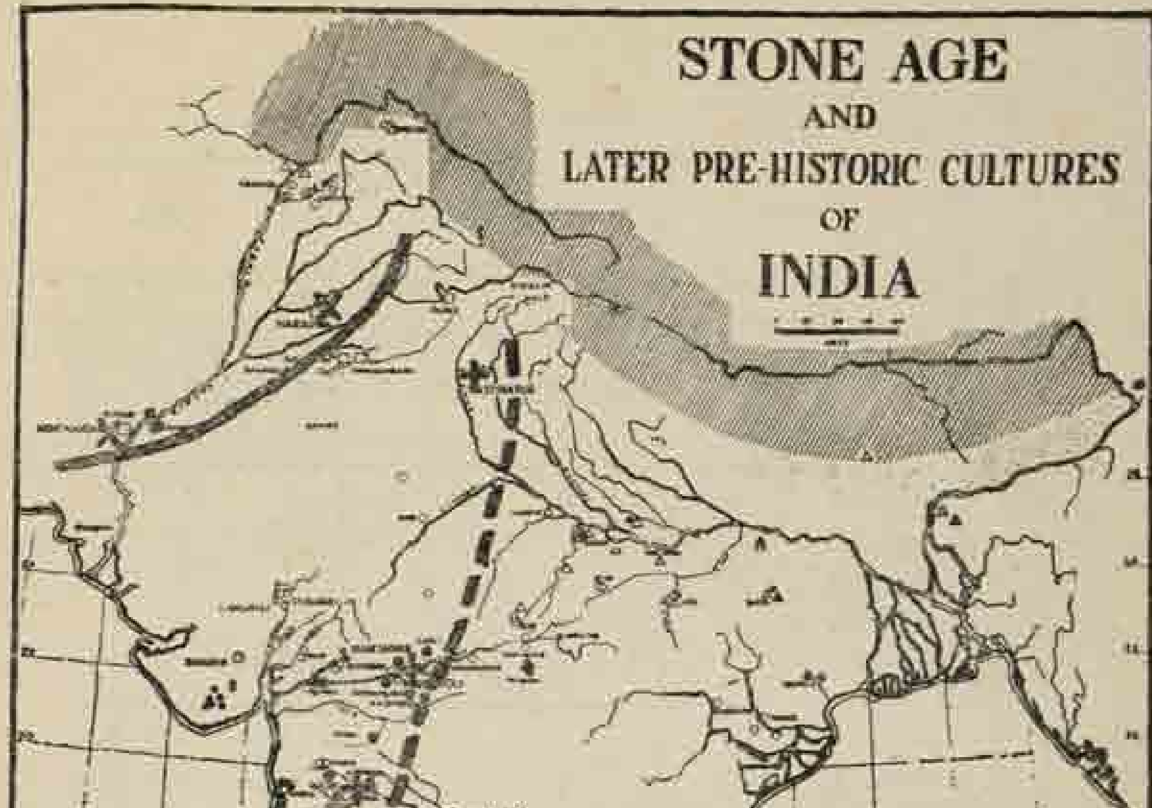

Map of India showing the comparitive distribution af wheat in the Harappan and Chalcolithic periods.

Text fig. 4

Appendix

MOUND IV

PHASE I

Trench	Stratum	Site No.	CEREALS			LEGUMES						MISCL.			
			Triticum vulgare compactum Type	Triticum s.	Oryza sativa	Pisum arvense	Lathyrus sphaericus	Lathyrus sativus	Phaseolus radiatus	P. mungo	Lens culinaris	Linum usitatissimum	Zizyphus jujuba	Phyllanthus emblica	Unidentified Fruit Type
I	5	9045	X				X						X		
		12843													
		12843A	X	X			X	X							
		12874	X			X	X				X				
		13002													
	6	13133	X												
		13135	X	X											
		13154	X												
		13287	X						X						
		13417	X												
	7	13565	X												
	8	13923	X	X											
	9	3528	X								X				
		14192	X												
		14227	X												
	10	1888	X												
		2140	X					X	X	X		X			
		2947	X				X				X		X		
		2948	X				X				X		X		
		300													
		3002	X					X							

MOUND IV

PHASE I—(*Contd.*)

Trench	Stratum	Site No.	CEREALS			LEGUMES						MISCL.			
			Triticum vulgare compactum Type	Triticum s.	Oryza sativa	Pisum arvense	Lathyrus sphaericus	Lathyrus sativus	Phaseolus radiatus	P. mungo	Lens culinaris	Linum usitatissimum	Zizyphus jujuba	Phyllanthus emblica	Unidentified Fruit Type
I	10	3493	X							X	X				
		3520	X												
		3551	X										X		
		3579													
		3591	X					X							
		3592	X	X											
		3656	X												
II	6	5080	X												
		5626	X					X	X						
		6234	X				X	X	X		X				
		6408													
		9045A	X					X			X				
	8	12712	X	X											

MOUND IV

PHASE II

Trench	Stratum	Site No.	CEREALS			LEGUMES						MISCL.			
			Triticum vulgare compactum Type	Triticum s.	Oryza sativa	Pisum arvense	Lathyrus sphaericus	Lathyrus sativus	Phaseolus radiatus	P. mungo	Lens culinaris	Linum usitatissimum	Zizyphus jejuba	Phyllanthus emblica	Unidentified Fruit Type
I	3	3441													
		3776	X			X		X			X				
		5907													
		11461A													
	5	5078													
		12608													
		12713	X	X											
		12852	X			X									
	6	581	X												
		614	X										X		
		727				X									
		758				X		X	X				X		
		816													
		9611	X												
		1078	X			X		X					X		
		1079	X												
		1131											X		
		1132				X		X							
		1133	X			X	X	X					X		
		1193	X					X					X		
		1246	X			X		X			X				
		1252		X											
		1417	X			X	X	X	X				X		

MOUND IV

PHASE II—(*Contd.*)

Trench	Stratum	Site No.	CEREALS			LEGUMES						MISCL.			
			Triticum vulgare compactum Type	Triticum s.	Oryza sativa	Pisum arvense	Lathyrus sphaericus	Lathyrus sativus	Phaseolus radiatus	P. mungo	Lens culinaris	Linum usitatissimum	Zizyphus jujuba	Phyllanthus emblica	Unidentified Fruit Type
		1423	X			X	X	X	X	X	X				
		1523													
		1531	X												
		1532	X	X									X		
		1571	X												
		1572	X												
		1597	X										X		
		1598	X										X		
		1599	X												
		1617	X												
		1642	X												
		1644													X
	6	1648	X												
		1650	X								X		X		
		1653	X												
		1654	X												
		1710													X
		1711													X
		1889	X			X		X		X					
		1942	X			X		X		X					
		1943	X		X			X			X		X		X
		2008	X								X		X		
		2100				X	X	X	X	X	X		X		
		2671	X								X				
		2711	X	X											

MOUND IV

PHASE II—(*Contd.*)

Trench	Stratum	Site No.	CEREALS			LEGUMES						MISCL			
			Triticum vulgare compactum Type	Triticum s.	Oryza sativa	Pisum arvense	Lathyrus sphaericus	Lathyrus sativus	Phaseolus radiatus	P. mungo	Lens culinaris	Linum usitatissimum	Zizyphus jujuba	Phyllanthus emblica	Unidentified Fruit Type
1	6	3445	X					X							
		3531	X												
		6408	X												X
		10607	X												
		11461	X												
		11586											X		
		11913	X												
		12228				X									
		12416											X		
		13003													
		13131				X									
		13134													
	7	676	X			X							X		
		748											X		
		856											X		
		977	X												
		1022	X												
		1481											X		
		2101	X								X				
		2187		X											
		2400	X						X		X				
		2401	X								X				
		2402	X								X				

MOUND IV

PHASE II—(*Contd.*)

Trench	Stratum	Site No.	CEREALS			LEGUMES						MISCL			
			Triticum vulgare compactum Type	Triticum s.	Oryza sativa	Pisum arvense	Lathyrus sphaericus	Lathyrus sativus	Phaseolus radiatus	P. mungo	Lens culinaris	Linum usitatissimum	Zizyphus jujuba	Phyllanthus emblica	Unidentified Fruit Type
		2599											X		X
		2600											X		
		2710	X			X	X	X							
		2751													
		2752	X			X	X	X	X	X			X		
		2793	X						X	X	X		X		
		2794	X			X	X	X							
		2795	X			X					X				
		2856	X			X	X	X					X		
		2942	X			X	X	X			X				
		3027	X										X		
1	7	2101	X			X		X			X				
		11744	X			X							X		
		12047													
		13136	X	X											
		13290	X										X		
		13291	X												
		13292													
		13295	X												
		13296	X												
		13297	X												
		13298	X												
		13372	X												
		13418	X				X	X							
		14198	X												

MOUND IV

PHASE II—(*Contd.*)

Trench	Stratum	Site No.	GEREALS			LEGUMES						MISCL			
			Triticum vulgare compactum Type	Triticum s.	Oryza sativa	Pisum arvense	Lathyrus sphaericus	Lathyrus sativus	Phaseolus radiatus	P. mungo	Lens culinaris	Linum usitatissimum	Zizyphus jujuba	Phyllanthus emblica	Unidentified Fruit Type
I	8	1192											X		
		2185	X												
		2709	X								X		X		
		3224				X	X	X							
		3355	X								X				
		13284	X												
		13289	X												
		13638	X	X											
		14201	X	X											
II	4	8098	X												
	6	6408	X												X

MOUND IV

PHASE III

Trench	Stratum	Site No.	CEREALS			LEGUMES						MISCL			
			Triticum vulgare Compactum Type	Triticum s.	Oryza sativa	Pisum arvense	Lathyrus sphaericus	Lathyrus sativus	Phaseolus radiatus	P. mungo	Lens culinaris	Linum usitatissimum	Zizyphus jujuba	Phyllanthus emblica	Unidentified Fruit Type
		9380	X												
	2	10608										X			
		11541	X												
		579	X			X									
		729	X			X	X	X			X				
		730						X			X				
		2289				X	X	X							
		2890	X												
		2932	X					X							
		3439				X							X		
		3440	X			X		X			X		X		
		3441	X			X		X			X				
		9957	X												
		9964				X			X	X	X				
1	3	10011				X			X	X					
		10013	X												
		10014	X												
		10015	X												
		10605	X												
		11080	X					X							
		11081	X			X	X	X							
		11265	X			X	X	X					X		
		11458	X										X		
		11600	X			X									
		11608										X			

MOUND IV

PHASE III—(*Contd.*)

Trench	Stratum	Site No.	CEREALS			LEGUMES						MISCL.			
			Triticum vulgare compactum Type	Triticum s.	Oryza sativa	Pisum arvense	Lathyrus sphaericus	Lathyrus sativus	Phaseolus radiatus	P. mungo	Lens culinaris	Linum usitatissimum	Zizyphus jujuba	Phyllanthus emblica	Unidentified Fruit Type
I	3	11743	X												
		12370				X			X				X		
		13004											X		
		14461A	X												
	4	920		Unidentified											
		978											X		
		1021		Unidentified		as in 920									
		1075											X		
		1077	X?												
		1134		Unidentified		as in 920									
		1195	X												
		1247	X												
		1807				X		X							
		1890	X			X	X		X						
		2010				X	X								
		2180			X										
		2184	X			X	X	X							
		2186	X						X						
		2242	X		X	X	X	X	X	X					
		2243	X					X							
		2244											X		
		2290	X		X	X	X	X		X					
		2362	X			X		X							
		2403	X										X		

MOUND IV

PHASE III—(*Contd.*)

Trench	Stratum	Site No.	CEREALS: Triticum vulgare compactum Type	CEREALS: Triticum s.	CEREALS: Oryza sativa	LEGUMES: Pisum arvense	LEGUMES: Lathyrus sphaericus	LEGUMES: Lathyrus Sativus	LEGUMES: Phaseolus Radiatus	LEGUMES: P. mungo	LEGUMES: Lens culinaris	MISCL.: Linum usitatissimum	MISCL.: Zizyphus jujuba	MISCL.: Phyllanthus emblica	MISCL.: Unidentified Fruit Type
I	4	3532	X			X		X		X					
		3978	X			X		X					X		
		3981	X					X							
		10604	X					X					X		
		10794	X												
		11150								X					
		11151	X										X		
		11248	X										X		
		11266				X					X				
		11269	X										X		
		11367	X			X	X	X		X	X		X		
		11462				X			X	X	X				
		11537	X												
		11539				X			X		X				
		11540	X												
		11607	X												
		11725	X												
		11851	X										X		
		11851A													
	5	580											X		
		1076	X			X									
		1080				X									
		1130	X												
		1188	X												

MOUND IV

PHASE III—(*Contd.*)

Trench	Stratum	Site No.	CEREALS			LEGUMES						MISCL.			
			Triticum vulgare compactum Type	Triticum s.	Oryza sativa	Pisum arvense	Lathyrus sphaericus	Lathyrus sativus	Phaseolus radiatus	P. mungo	Lens culinaris	Linum usitatissimum	Zizyphus jujuba	Phyllanthus emblica	Unidentified Fruit Type
		1191											X		
		1199	X												
		1244											X		
		1245													X
		1248	X												
		1249													X
		1251	X												
		1295	X												
		1383	X												
		1418				X		X							
		1419	X			X	X	X		X					
		1420	X			X	X	X		X					
1	5	1421	X			X		X			X				
		1482	X												
		1533									X				
		1570									X				
		1640	X								X				
		1641	X								X				
		1646	X												
		1646	X												
		1647	X								X				
		1651	X					X							
		1714	X												
		1887	X			X		X							X
		2051	X												

PHASE III—(*Contd.*)

Trench	Stratum	Site No.	CEREALS				LEGUMES					MISCL.			
			Triticum vulgare compactum Type	Triticum s.	Oryza sativa	Pisum arvense	Lathyrus sphaericus	Lathyrus sativus	Phaseolus radiatus	P. mungo	Lens culinaris	Linum usitatissimum	Zizyphus jujuba	Phyllanthus emblica	Unidentified Fruit Type
I	5	5078	X		X	X		X	X						
		11369	X	X									X		
		11745	X												
	6	1190	X								X				
		1713	X			X	X	X			X				
		1715	X									X			
		2009	X								X				
		2011												X	
		2012												X	
		2050	X								X				
II	2	2892	X												
		9037A	X					X			X				
		9343	X												
		12369	X										X		

MOUND IV

PHASE IV

Trench	Stratum	Site No.	CEREALS: Triticum vulgare compactum Type	CEREALS: Triticum s.	CEREALS: Oryza sativa	LEGUMES: Pisum arvense	LEGUMES: Lathyrus sphaericus	LEGUMES: Lathyrus sativus	LEGUMES: Phaseolus radiatus	LEGUMES: P. mungo	MISCL: Lens culinaris	MISCL: Linum usitatissimum	MISCL: Zizyphus Jujuba	MISCL: Phyllanthus emblica	MISCL: Unidentified Fruit Type
		2933					X						X		
		3442	X						X				X		
		3443	X					X					X		
		3988					X								
		10441					X	X			X		X		
		10605	X					X							
		10687						X							
		10687A						X							
	2	10795										X			
		10796										X			
		10787										X			
		10946	X												
		10948	X					X							
		11264	X			X		X							
		11268A	X		X										
		11535										X			
		14200			X										
		14229						X							
		14230	X												
		9044											X		
	3	10343	X					X					X		
		10793													
		11368													

III

A NOTE ON THE EARLY HISTORY OF SILK IN INDIA

By

A. N. GULATI

A NOTE ON THE EARLY HISTORY OF SILK IN INDIA

By

A. N. Gulati.

Recent excavations made at Nevasa (District Ahmadnagar, Maharashtra State, India) bring to light the use of silk string for making necklace of copper beads as early as 10 to 15 centuries B.C. This necklace was found round the neck of the skeleton of a child buried in grey urns in Burial No. XL, sealed by layer (2) and exposed at a depth of 28·75 ft. Remnants of the string employed were found inside three beads only, of which there were as many as sixteen (Pl. 1, Fig. 1). Some of the beads showed signs of a crust of mud round them, while others were tarnished and varied in shade from dark brown to greenish. The ends of the string wherever the same were protruding, had a light greenish tint, indicating their saturation with copper salts.

The remains of the string were forced out of two beads with the help of a fine needle for detailed microscopical examination. The remains were extremely brittle and were reduced to powder on the application of the slightest pressure on them. An end protruding out of a bead revealed the four-ply twisted structure of the string even to the naked eye. This end was only about 2 mm. in length. This piece when mounted in glycerine and examined under a microscope, revealed the presence of 20 to 25 fibres in the cross-section of each of the four plys. A photomicrograph was taken. It is reproduced as Pl. 1, Fig. 2.

It will be seen that all the fibre-ends are embedded in a structureless mass, which could not be easily removed. In other words, the fibre ends could not be freed any more than are seen above in the photograph. The denier of the fibres or the yarns could not be determined gravimetrically. The diameter of the fibres was the only measurable property. The following thirty measurements were made on two different occasions using slightly varying magnifications on two different microscopes. Using the calibrations of the measuring scales employed on each occasion, the diameter readings in microns were as under:—

1	7.9	11	12.1	21	12.1
2	21.5	12	7.2	22	9.9
3	8.6	13	4.8	23	7.0
4	11.6	14	17.2	24	8.6
5	12.4	15	8.2	25	15.2
6	18.2	16	11.7	26	16.5
7	10.5	17	17.8	27	20.0
8	12.4	18	18.2	28	8.0
9	14.6	19	10.5	29	14.3
10	7.9	20	11.4	30	17.8
Total	125.6	Total	119.1	Total	129.4

Grand total = 374.1; Mean value = 12.47 microns.
Maximum value = 21.5 microns ; Minimum value = 4.8 microns.
Range = 16.7 microns ; Standard deviation = $\pm$ 4.39.

The above measurements and the microscopical appearance of the fibres show that:—

(i) The fibres used in the manufacture of the string cannot be any other than of natural silk. There is, however, no direct means of ascertaining whether the silk used was derived from cut coccoons or from unwound coccoons, a practice which was not known in India, but was prevalent in China from 27th century B.C., because the material available was never more than two millimetres in length and their continuity into filaments could not be established.

(ii) The above conclusion was further stengthened by the somewhat triangular shape of the ends of two fibres at least, which are seen in the photograph.

(iii) The variation in fibre-diameter as indicated by the standard deviation indicates that the material is from a homogeneous population and not derived from two different sources. The fibres under study are apparently derived from very fine silk of about one denier.

(iv) One of the many preparations examined revealed the presence of a nep of cotton fibres in the body of the string, an indication

that the thread had been spun on a cotton spinning appliance. A nep is an entangled mass of short bits of cotton fibres often seen protruding from the surface of hand-spun cotton yarns.

In order to confirm the above conclusion, some of the fibre pieces were boiled in 10 % caustic soda and 80° Tw. sulphuric acid. In both cases the fibre pieces dissolved away readily leaving a structureless mass in which the same were embedded. The cotton nep was left in the case of caustic soda boil. This mass in untreated condition was found to contain some oil globules, fungal spores (Family: *Spheriaceae*) and vegetable cells and epidermal hairs from the stem of Millet or allied grasses. Both the spores and the vegetable cells lead one to the use of cattle-dung and oil in burial rites of the people to whom the child belonged.

The above discovery takes back the use of natural silk for threading beads to make necklaces, a practice quite prevalent before the advent of artificial silk threads in the beginning of the 20th century throughout India, to as early a period as between 10 to 15 centuries B.C. Silk in India has so far been traced only upto 8th century B.C. (*Kusa* was interpreted by Sāyaṇa as silk in *Satpatha Brāhmaṇa* (V. 2, 1.8).

It may be mentioned in this connection that according to written history in China (Book of Chooking) the earliest report on silk is as old as the second half of the third millenium B.C. This report describes Shoutung as the cradle of silk weaving. It was princess Si-Ling-Chi, wife or daughter of Emperor Hoang-to, who discovered for the first time in 27th century B.C. that what the silk worm could wind, man may unwind. As this discovery marked the beginning of utilization of silk by man, the above-named princess was admitted to the "Company of Gods" in China according to VARRAN, A. (*Textile Colorist*, 1939).

Conclusions

1. The appearance of the present material being white and not yellow, though the fibre bits were found embedded in a yellowish mass, shows the use of white silk in India around 10th to 15th century B.C. This would, thus, appear to be the earliest record of the use of silk in India, so far, which takes the history back by about five hundred years.

2. It was apparently spun from cut coccoons on the cotton spinning appliance as indicated by the presence of a cotton 'Nep'.

3. The presence of millet cells and epidermal hairs beside fungal spores indicates the use of cattle-dung in burial rites.

4. The presence of oil globules in the material found surrounding the string indicates the use of oil for annointing the human body both during life and/or after death.

5. The presence of cotton nep showed that cotton was also being spun at the time.

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Fig. 1:- Copper bead necklace

Figure 2. Mag. × 200

Showing fibres protruding from two plys.